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ABSTRACT

Implementing computers and other elements of high tech into the classroom involves sound visionary planning, a comprehensive, diverse group of educators, and on-going staff development. The computer should be used as a problem-solving tool in a variety of settings and applications, the ramifications of which demand that educators in all subject areas and at all levels be computer literate and able to utilize the computer appropriately as a problem-solving tool. If the "3 'R's"--Reaching Out, Revamping, and Retraining--are properly addressed, education can begin the task of infusing high tech into educational environments. "Reaching Out" involves extending the scope and number of the personnel involved with the infusion process and requires technology leadership, computer literacy, pilot programs, and progressive involvement. "Revamping" involves not only changes in the teacher's role and in curricula, but in the educational structure, and knowledge of computer applications will be essential. "Retraining" provides personnel with new skills and a better understanding of how to use existing skills to infuse high tech in various areas. Attention must be given to the commonality of processing data and the realization that the basis of learning is how we process information. The "New 3 'R's" are consistent with the findings of research on improving the quality of education in that they address and advocate the use of the computer and other high tech developments as creatively applied and appropriately integrated tools. (DJR)

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The New 3 "R"s In Education

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The New 3 "R"s in Education

Implementing the infusion of the computer and other elements of high tech into the classroom involves sound, visionary planning. Last year we presented a paper at the NCSIE National Conference entitled "Fitting Computers Into The Curriculum." That presentation stressed the planning aspect of integrating the use of the computer. We would like to take that planning one more step towards the actual implementation of integrating the computer into the curriculum and educational environment. Since this implementation involves a comprehensive, diverse group of educators; staff development becomes an integral component of both the planning and implementation.

If we accept the computer and other high tech developments as modern problem-solving tools, we must not think in terms of needing additional, detached courses of studies. Beyond penmanship in the primary grades, we do not have a separate course on using pencil and paper. But, rather, we master and extend our usage of such tools by using them in a variety of settings and applications. Besides an introductory computer literacy course and, perhaps, an introductory programming course, the computer should be used as a problem-solving tool in a variety of settings and applications. The ramifications of such a philosophy demands that educators in all subject areas, at all levels, be computer literate and that they be able to appropriately incorporate the computer as a problem-solving tool. We would like to suggest 3 "R"s needed today in education: Reaching Out, Revamping, and Retraining. If these 3 issues are properly addressed,

we, as educational leaders, can begin with the great task of infusing high tech into our educational environments. We do so with the belief that it will improve the quality of instruction and the effectiveness of the resulting learning.

The National Task Force on Educational Technology's report to the Secretary of Education " Transforming American Education : Reducing the Risk to the Nation " stated the Task Force's conviction that

> " information technology represents a powerful array of tools that when creatively applied and appropriately integrated will help three fundamental goals: improving the quality of learning; increasing the equity of opportunity, access and quality; and ensuring greater cost effectiveness."

"Reaching Out" is extending the scope and number of the personnel involved with the infusion process. The infusion implementaion will not be achieved quickly or easily. The number of educators and the commitment of educators at different levels make the process more complex and slower. Yet it is this same involvement and support that is needed to make the process work. Key factors include technology leadership, computer literacy, pilot programs, and involvement progression.

Technology leadership should consist of personnel who can interface between the technical aspects of the high tech developments and the classroom. Aspects such as networks, system security, programming laser disks, electronic communications, bulletin boards, and robotics need personnel with technical expertise to set-up, operate, and maintain. Such technical personnel may not also be trained as educators. The technology leader must be educationally inclined to intereact with curriculum specialists and generalists in infusing the available technology creatively, appropriately, effectively, and efficiently. This infusion process may expand the curriculum in a manner not possible without the technology. This interfacing between

the technology and the learners' needs is a complex and time-consuming process which includes a substantial amount of awareness training in the capabilities and limitaions of the technology.

Computer literacy is introducing the greatest number of people to processing data and using computers in the shortest possible time. It is very global, because the training needed to actually implement the infusion will need to be more specific and personal. Emphasis should not be given to a specific machine or software package, but to the general way that computers work and then some specific examples in a variety of applications. The intent should be to sell the interest in getting involved and to have potential participants in the infusion process start thinking of how THEY can involve the computer in THEIR area.

Any attempts to include programming as part of computer literacy should stress the concept of input, processing, and output. In light of the current trend in software of using menus and windows, exposure to procedures and menus would be helpful.

Key teachers can pilot programs and then reach out to their colleagues for involvement and to serve as a mentor or "master teacher". Pilot programs should be encouraged and supported for they secure involvement and commitment. Planning for pilot programs should initiate the necessaary cooperation between the technology leadership, curriculum generalist, curriculum specialist, and classroom teacher. The concept of mentor and master teacher address the current perception of the need to improve teacher professional development. The National Task Force on Educational Technology suggests the same concept on a more global basis : demonstration

schools. Pilot programs also are a vital component in the involvement progression.

The progression of involvement tends to have a snowball effect. Pilot programs spawn new pilot programs and modifications to existing programs. Peer support and enticement tend to spread like wildfires. Involvement can progress quicker at first when initiated and advanced from the top. But, use of the peer method will gain a wider base of support and once started, will progress quicker and smoother.

We are involved presently with pilot programs in writing, research, math, and commercial art. We train students who failed the writing component of the New Jersey High School Proficiency Test in the use of word processing and then make it available to them. Initial response has been increased interest, involvement, and progress. The Seminar in Research class has used computers for data searches and word processing. The Probability and Statistics class has utilized BASIC programs, FORTRAN programs, and a canned statistics program. Commercial Art has incorporated the Macintosh and Laserwriter. Plans are now being formulated to offer an "Electronic Graphics & Publishing" course that will combine the use of the computer with copying machines and offset presses.

Reaching out can also be used as a technique to revitalize the creativity and productivity of "burned out" colleagues.

Revamping includes the transition of staff to new positions, changing positions, and changing curricula. Technical advances can offer program possibilities not previously considered to be feasible.

The Task Force suggests that using computer-managed-instruction redefines the role of teachers to that of "managers of a complex educational

environment." Even if we infuse the use of computer as a problem-solving tool, and not as computer-aided-instruction, the role of the teacher will change. As the students increase "hands-on" time, less time will be needed (and less time available) for traditional dispersement of information. The emphasis would be on processing information that students can readily access.

A more visible revamping will need to come from the educational structure. Districts need to have technology specialists and technicians. If districts can not afford such skilled personnel,who will command enough money to keep from being lured into more lucrative positions in the private sector, districts may have to share personnel or set up a "pool" of such personnel on a county or regional basis. Districts need to accommodate the time needed to get personnel together to coordinate efforts. Perhaps this means paying teachers to work summers at school instead of lawn care, insurance sales, real estate sales, and other lucrative moonlighting positions. Districts need to plan for substantial expenditures for computer acquisitions, upgrades, software, and training. Partnership with the business community could prove helpful.

Instructors of courses involving a great deal of writing should be knowledgeable of word processing and how to properly manage its use. Making revisions much easier can elevate expectations of the quality of the finished product. Students having difficulty in writing may have fine motor disabilities or not be conscientious enough to bother making necessary revisions. Research papers can now access larger data bases by way of electronic communications. Students need to receive instructions on doing data searches. Simulations can replace SOME costly or dangerous science

experiments. Teaching statistics can concentrate on the theories and inductive discoveries instead of computations. Commercial art and drafting will never be the same since the inception of the Macintosh and Laserwriter. Desktop published is becoming commonplace. Elementary reading and writing can now be enhanced with the use of 'talking' computers. Accounting needs to incorporate the use of spreadsheets and model making. Robotics can be tied in to the kineseology of the human body.

The Task Force further recommends 1 work station per 10 students, transformation from learning based on time-in-grade to individual progression, research and development in this area, and inclusion of technology expenses as regular budget items. States need serious investigation into graduation requirements that include the use of computers. Certification requirements may need to be revised to ensure continued training. States and districts will need to address the need for additional, on-going training.

Retraining deals with providing personnel with new, modern skills and a better understanding in using existing skills to infuse the high tech in various areas. Much of this retraining includes a philosophy of learning. Attention must be given to the commonality of processing data and the realization that the basis of learning is how we process information. This information can be letters, words, numbers, musical notes, brush strokes, or concepts.

We tend to process data in the simpliest form of input, processing, and output. Our bodies function by receiving input by way of our 5 senses , using our brains to think of the proper response, and using our bodies to

respond accordingly. The storage of data also occurs as we remember experiences upon which future processing should use.

Examples of the commonality of how many students learn in a variety of educational settings will be given:

In teaching computer programming, students are taught to write good programs by using a 5 step approach:

1. Review program specifications (Understand the problem).
2. Program design (plan of attack).
3. Program coding (translate ideas to computer language).
4. Key code into computer.
5. Test execution of program and debug if necessary.

A similar approach to writing composition, using a word processor :

1. Review assignment/topic.
2. Gather/organize ideas (notes,outline).
3. Develop rough draft.
4. Type into computer.
5. Edit/revise.

Solving "word" problems in math:

1. Read, understand the problem.
2. Design solution.
3. Develop formulas/equations
4. Solve the equation.
5. Test answers/revise work if necessary.

In science:

1. Define the problem.
2. Create hypothesis.
3. Design experiment to test the hypothesis.
4. Do the experiment.
5. Draw conclusions.

Building a project in wood working:

1. Decide what to build.
2. Plan construction/structure.
3. Build primary structure.
4. Build secondary structure.
5. Finish.

Research report using an electronic data base:

1. Decide on topic.
2. Plan search/locate sources.
3. Notes/organize notes.
4. Rough draft.
5. Revise/edit.

An understanding of how we tend to process information in a similar manner in a variety of settings can be most helpful when having personnel

from different departments work together to plan meaningful learning experiences.

Retraining can include computer literacy, but really needs to go beyond such an introduction. A more personal and specific approach is needed. For example, in addition to awareness of a word processor, an instructor would need to be comfortable with the use of the word processor to be used in the classroom before they could properly infuse it into their classroom. Training and time to actually use it would need to be made available and monitored. The technology specialist can provide the spark to start the retraining, and then participants can help train their colleagues.

Consistent with the findings of the National Task Force on Educational Technology and other research on improving the quality of education, the "New 3 R's" address and advocate the conviction of using the computer and other high tech developments as "tools when creatively applied and appropriately integrated." Such an undertaking requires a great deal of time, effort, and money. Duplication of efforts and equipment only hinders the progress. Cooperation between various constituents is vital. Sound, visionary planning and creative ideas are needed to create an atmosphere of steady progress towards a higher quality of education for our students through the infusion of the computer and other high tech developments.